

# PRO V&V



6705 Odyssey Drive  
Suite C  
Huntsville, AL 35806  
Phone (256)713-1111  
Fax (256)713-1112

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## Test Plan for EAC 2005 VVSG Certification Testing Unisyn Voting Solutions OpenElect 2.1 Voting System

EAC Project Number: UNS10121966-2.1

Version: 03

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U.S. Election Assistance Commission

# VSTL

EAC Lab Code 1501

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**SIGNATURES**

Approved by:

*Diann Gray For*  
Michael Walker, VSTL Project Manager

10/8/19  
Date

Approved by:

*Wendy Owens*  
Wendy Owens, VSTL Program Manager

10/8/19  
Date

**REVISIONS**

<b>Revision</b>	<b>Description</b>	<b>Date</b>
00	Initial Release	07/16/2019
01	Updates per EAC comments; corrected typos; removed hardware modification/test information where applicable; added Change Release Notes to TDP table; and reformatted.	08/08/2019
02	As-Run	10/01/2019
03	As-Run. Updated document version in Table 4-2	10/08/2019

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## 1.0 INTRODUCTION

The purpose of this Test Plan is to document the procedures that Pro V&V, Inc. will follow to perform certification testing during a system modification campaign for the Unisyn Voting Solutions OpenElect Voting System (OVS) Version 2.1 to the requirements set forth for voting systems in the U.S. Election Assistance Commission (EAC) 2005 Voluntary Voting System Guidelines (VVSG), Version 1.0. Prior to submitting the voting system for testing, Unisyn submitted an application package to the EAC for certification of the OpenElect 2.1 Voting System. The application was accepted by the EAC and the project was assigned the unique Project Number of UNS10121966-2.1.

At test conclusion, the results of all testing performed as part of this test campaign will be submitted to the EAC in the form of a national certification test report.

### 1.1 Description and Overview of EAC Certified System Being Modified

*The EAC Certified System that is the baseline for the submitted modification is described in the following subsections. All information presented was derived from the previous Certification Test Report, the EAC Certificate of Conformance and/or the System Overview.*

The OVS 2.0.A is a paper ballot voting system using touch screen and scan technology to scan and validate ballots, provide voter assisted ballots to accommodate voters with special needs, and tabulate results. The OCS, FVT, OVO, OVI-VC, and OVCS components of the OVS 2.0.A have previously been tested as part of the OVS 2.0 test campaign. The OVS 2.0.A consists of the following major components:

- **OpenElect Central Suite (OCS)**
- **OpenElect Voting Optical (OVO)**
- **OpenElect Voting Interface – Vote Center (OVI-VC)**
- **FreedomVote Tablet (FVT)**
- **OpenElect Voting Central Scan (OVCS)**

The OVO, FVT, and OVI-VC are the OVS components designed to accept voter input. The FVT and OVI-VC are the OVS ballot marking devices (BMDs). The OVO can collect and tally precinct votes, generate reports, and store election data internally. The OVCS is the bulk scanner used for mail-in ballots, provisional ballots, and recounts.

#### **Open Elect Central Suite (OCS)**

The OCS System supports elections on the OVO, OVI-VC, FVT, and OVCS systems. The Election Management System (EMS) consists of the following components running as either a front-end/client application or as a back-end/server application:

Ballot Layout Manager (BLM) – uses a database to create and store precinct and district information and an interface to create, check, translate, and produce the ballot styles needed by a jurisdiction for an election. The BLM output is printer ready artwork of all ballots in all languages and the Unisyn election definition file.

Election Manager (EM) – converts the Unisyn election definition file to a Unisyn-specific XML format and prepares compressed, encrypted election files for output to CD or USB. The EM allows the jurisdiction to add voting device specific options for elections, i.e. whether to check the contests for undervotes, and whether to allow or disallow certain features such as sounds, party icons, reports, etc. The EM also creates and manages Supervisor and Maintenance technician logins and passwords.

Tabulator Client (TC) – retrieves vote files and ballot images from a Transport Media (TM) device (USB), stores them on its disk, and transfers the files to the Tabulator and notifies the Tabulator that a new file is present.

Tabulator (Tab) – receives and validates uploaded voting data and provides a status of uploaded files as well as handling Rank Choice Voting (RCV) functionality. It also updates the database with adjudicated ballots from the Auditor application. The Tabulator maintains the Tabulator database, which stores the results from all precincts.

Auditor – accesses ballot images and data from the OVCS and TC PCs to allow jurisdiction personnel to evaluate ballots with questionable or erroneous marks and change votes in accordance to the voter’s perceived intent. The Auditor can also be used to process write-in votes. All changes uploaded to the Tabulator database and actions are password controlled.

Tabulator Reports (TR) – accesses data from the Tabulator database to generate the necessary reports.

### **OpenElect Voting Optical (OVO)**

The OVO is a full-page dual-sided optical scan precinct scanner that scans and validates voter ballot pages and provides a summary of all ballot pages cast. The election is loaded from an Election TM. On Election Day, an OVO at each poll location scans and validates voters’ ballots, and provides precinct tabulation and reporting. The OVO runs Logic Tests and Training Elections in addition to General and Primary Elections. The OVO unit can also be paired with OVI-VC and FVT units for early voting to scan and tabulate early voting ballots and election support at voting centers.

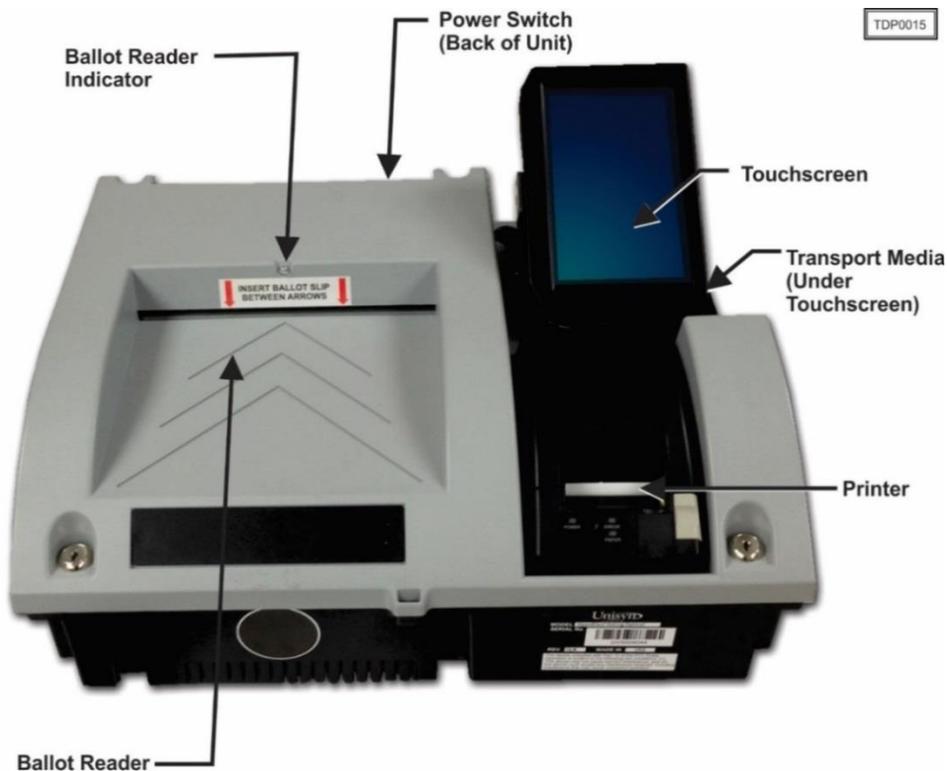
OVO units can be used at election headquarters to read absentee, provisional or recount ballots in smaller jurisdictions.

The OVO consists of the following components:

- **Personal Computer (PC)** - Computer component (with a touch panel display) has the OVO application installed that manages data and provides a user interface for voting and maintenance. A new election loaded via a Transport Media (TM) sets passwords,

parameters, and ballot styles for that election. (Valid ballots for a poll location are reinitialized or set on Election Day startup by scanning a ballot header card).

- **Transport Media (TM)** – 1 GB or larger USB thumb drive that provides the means of transporting audit, optional ballot page images and results files from the precinct on Election Night to Election Headquarters where the central count system resides.
- **Ballot Reader** - Dual-sided scanner connected to the PC to scan data from marked ballot pages. The Ballot Reader ejects accepted ballot pages into an attached ballot box or rejects unaccepted ballot pages back out to the voter.
- **Printer** - 58 mm thermal receipt printer connected to the PC to print voter receipts and reports at the OVO.
- **UPS** - Uninterruptible power supply is provided as part of the system.



**Figure 1-1. OVO**

### **OpenElect Voting Interface – Vote Center (OVI-VC)**

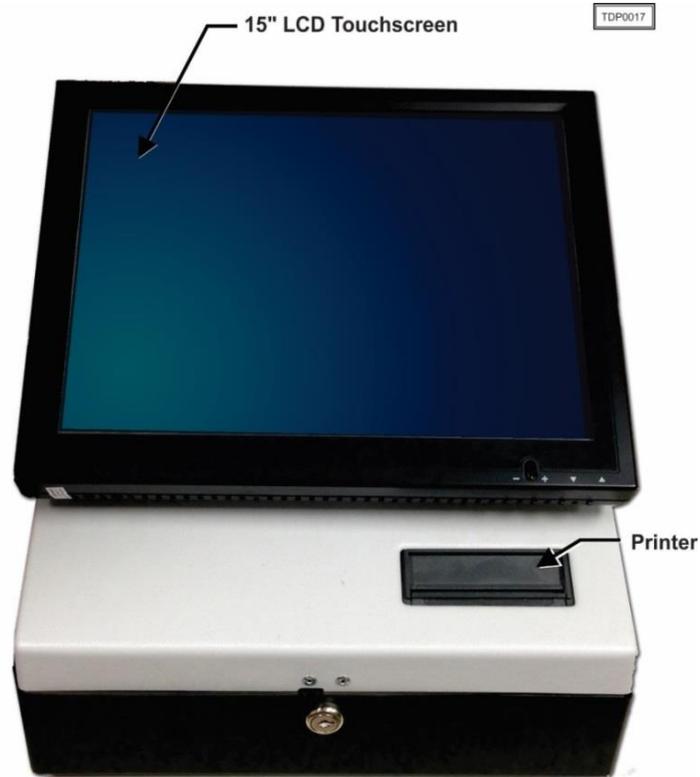
The OVI-VC is a ballot marking device (BMD) that supports both ADA and Regional Early Voting requirements. The OVI-VC has a 15-inch display and is equipped to assist voters, with varying abilities, to prepare their ballots independently and privately. It presents each contest on the correct ballot to the voter in visual and, if needed, audio formats. The OVI-VC gives voters the option to use an audio ballot, ADA keypad, sip and puff binary device, and touchscreen with varying font sizes to make their selections. Once the voter has made their selections, they are prompted to review their ballot selections. After the validation process is complete, the OVI-VC

then prints the ballot and the voter inserts it into the OVO to cast their vote. When authorized, the OVI-VC provides for write-in candidates.

Each OVI-VC can support multiple languages for both visual and audio ballots, allowing the voter to choose their preferred language.

The OVI-VC consists of the following components:

- **Personal Computer (PC)** - Computer component (with a touch panel display) has the OVO application installed that manages data and provides user interfaces for voting and maintenance. A new election loaded via a Transport Media (TM) sets passwords, parameters, audio, and ballot styles for that election.
- **Transport Media (TM)** - USB device with 1 GB or larger storage provides the means of transporting audit files to the OCS system.
- **Printer** – 82.5 mm thermal receipt printer is connected to the PC to print BMD Ballots and reports at the OVI-VC.
- **UPS** - Uninterruptible power supply is provided as part of the system.



**Figure 1-2. OVI-VC**

## **Freedom Vote Tablet (FVT)**

The FVT is a tablet ballot marking device that enables voters make their vote selections and to print their voted ballot. It can be used on Election Day or during an early voting period. Like the OVI-VC, the FVT is ADA compliant. It assists voters, with varying levels of ability, through the voting process, ballot review, and printing functions. The FVT presents each contest on the ballot style to the voter in visual and/or audio formats. It facilitates special needs voters through a variety of methods including wheelchair access, sip and puff, zoom-in ballot function and audio assistance for the visually impaired. The voter with limited vision can navigate through the ballot using an audio ballot and the ADA keypad or touchscreen to input their selections. Once the ballot is printed, it is taken to the OVO to be cast. Each FVT can support multiple languages for both visual and audio ballots, allowing the voter to choose their preferred language.

The FVT consists of the following components:

- **Tablet** – The Android tablet has a 13.3 in. touchscreen and comes with pre-installed software that provides user interfaces for voting and maintenance. Election files generated by the EM are loaded manually via a USB. The election files will allow the jurisdiction to determine the FVT’s mode such as early voting or training, sets passwords, parameters, audio, and ballot styles for that election.
- **Barcode Reader** - 2D USB Barcode reader will read the 2D barcodes produced by the EM such as the initialize barcode and administrative/maintenance barcodes. It will also read the ‘populate’ barcode produced by other qualified systems.
- **USB Hub** – A four port USB hub is installed in the FVT case to connect the printer, barcode scanner, and keypad to the tablet.
- **Printer** – 82.5 mm thermal receipt printer is connected to the Tablet to print BMD ballots and reports.
- **Optional ADA Devices** – 10-key keypad with Sip and Puff Interface, Headphones, Sip and Puff Device.



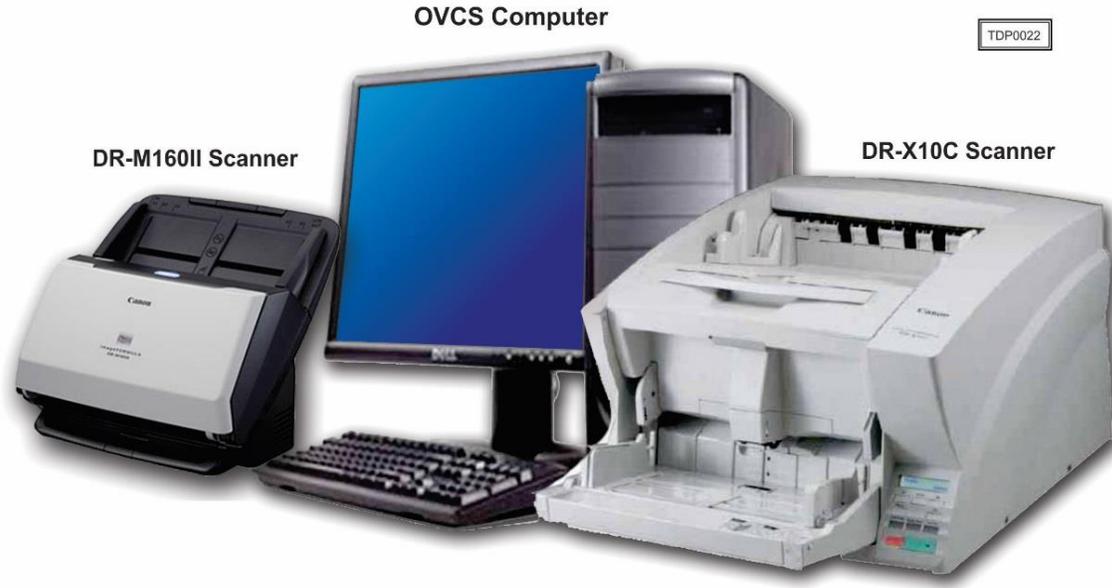
Figure 1-3. FVT

### OpenElect Voting Central Scan (OVCS)

The OVCS units reside at election headquarters designated to read absentee, provisional or recount ballots in large jurisdictions or read the entire election's ballots at a central count location in smaller jurisdictions. The OVCS also captures Write-In data images and produces a Write-In image report for manual processing upon request. The OVCS system consists of the following components:

- **PC Desktop** – A desktop PC configuration with the following minimum characteristics:
  - PC: 1.8 GHz Processor, 2 GB RAM, 250GB (or larger) Hard Drive, USB Ports, Network Interface Port (Ethernet), CDRW/DVD, Video Port
  - 16:9 LCD
  - Keyboard and Mouse

- **Bulk Scanner** – A dual-sided scanner (either Canon model DR-M160II or model DR-X10C) that is connected to the PC to scan data from marked ballots.



**Figure 1-4. OVCS**

**1.1.1 Baseline Certified System**

The baseline system for this modification is the OVS 2.0.A Voting System. The tables below describe the certified equipment and firmware versions. Detailed descriptions of the OVS 2.0.A test campaign are contained in Pro V&V Report No.TR-01-01-UNI-003-01.01 Rev. A, which is available for viewing on the EAC’s website at [www.eac.gov](http://www.eac.gov).

*This subsection lists the proprietary and COTS software to be provided by the manufacturer as part of the test campaign.*

**Table 1-1. OVS 2.0.A COTS Software Components**

<b>FVT, OVO and OVI-VC Device Software</b>	<b>Version</b>
CentOS Linux (OVO and OVI-VC)	6.3
Java JRE + Unlimited Cryptographic Extension	1.6.0_02
Android OS (FVT)	4.4.4

**Table 1-2. OCS and OVCS COTS Software Components**

OCS and OVCS Device Software	Version
CentOS Linux	6.5 and 6.8
Java JRE + Unlimited Cryptographic Extension	1.6.0_02
Apache-Tomcat Application Server	6.0.13
MySQL Database (BLM, EM, A, and Tab only)	5.0.45-7
JasperReports	2.0.5
OpenVPN	2.4.4
OpenSSL	1.0.1f
OpenSSL FIPS Object Module	2.0.10 (cert #1747)

**Table 1-3. Voting System COTS Hardware**

Hardware	Make	Model
<b>OVO</b>		
<i>Duplex Ballot Scanner</i>		
Duplex Ballot Scanner	PDI Scan	Pagescan III
Scanner Power Adapter	eUrasia Power	uA36-1024
<i>58 mm Thermal Printer</i>		
58 mm Thermal Printer	Citizen Printer	CT-5281
Printer Power Adapter	Citizen Printer	28AD4
<i>Computer</i>		
Chassis	Morex	Morex 2699
Power Adapter	DC/DC converter	MX-0608F
Motherboard	Jetway	JNF9D-2550
Memory	SuperTalent - Onboard RAM	3120-21282
Hard Drive	Western Digital	WD5000AZLX
Adapter	EDAC	EA 10951c-120
<i>1 Gb USB TM</i>		
Innodisk	1 Gb USB	DEUA1-01G172AC1SB-B088
Delkin	1 Gb USB	SLC-MLC
<i>7" LCD Touchscreen Display</i>		
7" LCD Touchscreen Display	Xenarc Technologies	700TSV
<i>AC Power In Module</i>		
AC Power In Module	Delta	Emi 10BEEG3G
<b>OVI-VC</b>		
<i>Sip and Puff (Optional)</i>		
Sip and Puff (Optional)	Origin Instruments	AirVoter
<i>Headphone (Optional)</i>		
Headphone (Optional)	Koss On-Ear Headphones	KPH5
<i>15 in LCD Touchscreen Display</i>		
15 in LCD Touchscreen Display	GVision	P15BX 2450-30120
<i>82.5 mm Thermal Printer</i>		
82.5 mm Thermal Printer	Star	TSP743IID-24, serial interface

**Table 1-3. Voting System COTS Hardware (continued)**

<b>Hardware</b>	<b>Make</b>	<b>Model</b>
Printer Adapter	Star	PS60A-24B 1
<i>Computer</i>		
Power Adapter Kit	DC-DC Converter	MX-0608F
Motherboard	Jetway	JNF9D-2550
Memory	SuperTalent - Onboard RAM	3120-21282
<i>Hard Drive</i>		
Hard Drive	Western Digital	WD5000AZLX
Adapter	EDAC	EA 10951c-120
<i>1 Gb USB TM</i>		
Innodisk	1 Gb USB	DEUA1-01G172AC1SB-B088
Delkin	1 Gb USB	SLC-MLC
<i>AC Power In Module</i>		
AC Power In Module	Delta	Emi 10BEEG3G
<b>OVCS</b>		
<i>Large Volume Scanner</i>		
Large Volume Scanner	Cannon	DR-X10C
<i>Desktop Scanner</i>		
Desktop Scanner	Cannon	DR-M160II
<b>FVT</b>		
<i>13.3 in Touchscreen Tablet</i>		
13.3 in Touchscreen Tablet	Android Tablet	GVision - T13
Tablets Battery Charger	Sager Power System	GC30B-4P1J
<i>82.5 mm Thermal Printer</i>		
82.5 mm Thermal Printer	Star	TSP743IIU-24
Printer Adapter	Lind 60W 24VDC	ST2425-626
<i>Barcode Reader 1D,2D series</i>		
Barcode Reader 1D,2D series	Newland	FM420
<i>USB Hub</i>		
USB Hub	Tripp Lite	USB Hub
Hub Adapter	Meanwell	PSD-15A-05
<i>1 Gb USB TM</i>		
Innodisk	1 Gb USB	DEUA1-01G172AC1SB-B088
Delkin	1 Gb USB	SLC-MLC
<i>Micro SD</i>		
Micro SD	Innodisk Industrial	Micro SD 2.0
<i>Battery</i>		
Battery Pack 12 V 6.0 AH	Powers Sonic	PSH-1255-FR
Adapter	Mean Well	GC30B-4PIL
<i>AC Power In Module</i>		
AC Power In Module	Delta	Emi 10BEEG3G
<i>Sip and Puff (Optional)</i>		
Sip and Puff	Origin Instruments	AirVoter

**Table 1-3. Voting System COTS Hardware (continued)**

Hardware	Make	Model
<i>Headphone (Optional)</i>		
Headphone	Koss On-Ear Headphones	KPH5
Headphone	Sony	MDR-210LP
<i>USB to Ethernet RJ45 Adapter (Optional)</i>		
USB to Ethernet RJ45 Adapter	D-Link	DUB-E100
<b>UPS</b>		
Minuteman Power Technologies	Para Systems, Inc.	Entrust

**Table 1-4. OVCS System COTS Software Components**

OVS Hardware	Version
Desktop for non-redundant solutions	Dell OptiPlex
Desktop for redundant solutions	Dell Precision
Canon Scanner (OVCS)	Canon DR-X10C or DR-M160II
Laptop	Dell Latitude

### 1.1.2 Description of Modification

The OVS 2.1 Voting System is a modified voting system configuration that contains updates to various components of the OpenElect Voting System. This release incorporates specific enhancement requests primarily centered on improving the end user experience. It also includes enhancements based on results of Vulnerability and Penetration testing conducted by DHS.

The list below includes the submitted software changes between the OVS 2.1 system and the baseline of the OVS 2.0.A Voting System as derived from the OpenElect Voting System Release Notes, System 2.0.A to 2.1, Version 1.0:

#### **Auditor (A)**

- Add ability for end user to write-in candidate's name in the Auditor application

#### **Ballot Layout Manager (BLM)**

- Allow color for the non-partisan party to be changed
- Added support for a superuser user to load a new registration key at any time
- Implemented rotation based on voter registration data, generate a precinct/contest report for all elections, regardless of rotation
- Implemented Decline to State (DTS) function to allow non-partisan voters to selection from a list of DTS parties
- Update ballot design to follow the EAC best practices

- Move sound scripts to BLM
- Increase button text character limits for the OVO and FVT in order to accommodate translated text
- Translate all voter facing messages
- Add the target color, Red or Black, to the Ballot's PDF name
- Change target color in drop down from 'Grey' to 'Black'
- Target example in Header Graphics made to match new ballot design
- Increase accuracy of text measurement when comparing against allocated space on ballot for Measure and Instruction Block text
- Change Election Proof Report to correctly represent full page width instruction blocks and measures
- Create separate translations for the OVO and FVT for the final voting screen in the Translation Tab
- Update Screen Reader introduction hint text to correctly describe method to show and hide the screen in Screen Reader mode
- Option to combined PDF of all printable ballots
- Ballot Text needs to support inline size tags for varied font sizes
- Allow dynamic flow across columns for measure text
- Add the ability to have a variable data field in the header that describes the ballot, for example General Election Ballot or Measures Only Ballot
- Adding option for split merging, to allow for splits to merge to highest split instead of automatically to parent
- Option to make candidate with most votes bold in machine summary reports
- Enable OVO checking of one-time use barcodes
- Allow Contest Headers to use up to 1000 characters and support all inline style tags
- Add additional translations for OVO screens such as Ballot Page Not Cast or Ballot Jam
- In the BLM Translation table added the ability to create a blank field or to add the text "No Translation"

## **Election Manager (EM)**

- Add readme file to election export to allow identification of election without having to decrypt files
- Add an option to the Election Manager's Common Options screen to print the candidate with the most votes in a contest in bold on the OVO and OVCS tally report
- Increment the EM portion of the election parameter version number when EM party icon is changed
- Move sound script management interface to the BLM to avoid moving between to application to correct/test sound files
- Include ballot style listed on QR barcode when election is exported by ballot style
- Adjust election version number when machines list in election are changed to allow better detection
- Allow user to select font size layout for the text on the Precinct Barcode Report
- Enable sound script editing
- Enable Audio Script report button regardless of "Require Sound Files" option
- Allow custom image on Thank you screen
- *DHS Security Suggestion:* Implement new TM USB handling with secure delete of files and signed unisyn\_tm.vol file and clear previous error messages.
- Create election\_info.txt file to contain election settings for reference without decryption
- Remove ambiguous letters and numbers from auto-generated passwords
- Remove 'Enter Alert Report Header Title' form OVO options screen, this text can be customized in the BLM Translations screen

## **FreedomVote Tablet (FVT)**

- Handle formatting tags in the Instruction blocks
- Add the ability to perform a diagnostic test on the Text-to-Speech function
- *DHS Security Suggestion:* Add system application API to allow the date and time to be changed from within the FVT application
- Add Election Type, Straight Ticket type, Retraction ID (if Set), Stub ID (if Set), and Android Build Number to the Machine Info Report

- Allow Custom image on Thank you screen
- Make the screen button text consistent in upper or lower case
- Change Write-in entry screen's BACK button action to a cancel function
- Decline to State (DTS) functionality
- Skip invalid machine key files during setup
- Translate All Voter Facing Messages
- Update FVT Star printer driver
- Update "Machine Type" from BMT to FVT on Machine Info screen
- Update sound play handling to be more extensible
- Change 'Done' and 'Print' buttons on the screen to green color
- Remove picture of phone with barcode on Main and Start screens
- In Diagnostics Auto Test, when Cancel button pressed, show a confirmation message (yes/no) to exit
- Update the keypad layout to swap the right arrow and the Enter keys
- Display Android build version on the Machine Info Screen and Machine Info Report
- Add FVT application validation/verification handling
- Adjust color contrast on FVT as suggested by accessibility group
- On the FVT ballot screen the Done and Print buttons are not available until the voter is required to use them
- Added process to delete the previous election in the event that the FVT was stored with an election still loaded and the password has been misplaced
- Fixed defect where Header border not drawing correctly in screen group
- Improve spacing on Initialization barcode ticket and add formatting options that have been set
- Use PNG images for buttons on the bottom of the voting screen
- Change alert indicator color for undervotes and no selection on summary screen from RED to YELLOW

- *DHS Security Suggestion:* FVT locks out all desktop access. The only user with access is a Superuser who has access to the special file in place on a Unisyn provided TM, in addition to requiring password
- *DHS Security Suggestion:* Update FVT to enable system power off feature
- *DHS Security Suggestion:* Machine keystore password should be updated on install to be devices specific
- *DHS Security Suggestion:* Update TM file cleaning process to a secure delete
- Text associated with BLANK candidate entry is displaying twice with Formatted Description only layout
- Remove ability to change Machine Name on setup screen
- Ballot Text needs to support inline size tags for varied sizes in a single block
- Allow Provisional Ballots to be printed on the FVT
- Enable OVO checking of one-time use barcodes for better security
- Allow the 'Done' button text on the FVT final voting screen to be changed in the BLM Translations, for example the text could be 'Review'
- Headers are increased (reference BLM)
- Reordered the layout of the Settings screen to improve its usability

#### **OpenElect Voting Interface (OVI-VC)**

- Implement 'Decline to State' function - allow Non-partisan voter to select from valid list of DTS parties
- Sound played after the ballot is printed is in the language selected
- Handle formatting tags in Instruction Blocks
- Improve the translation ability for Multiple Screen Header Text

#### **OpenElect Voting Central Scan (OVCS)**

- Add ability to enter custom names for OVCS sessions
- Allow export of OVCS session data to a TM for upload with the TC
- Adjust the definition of a mark and implement changes to support
- Add option to print in bold the candidate with the most votes in a contest on the tally report

- Process two column ballots with and without RCV with separate definition to improve performance
- Rotate the BMD full ballot image display in the write-in report to make it more readable
- *DHS Security Suggestion:* Update TM file cleaning process to a secure delete
- Will recognize FVT Provisional ballots as provisional “P” ballots and not as BMD “D” ballots and handle accordingly
- Upload button is disabled after sorting any column in descending order in session list

### **OpenElect Voting Optical Scan (OVO)**

- Add option to print in bold the candidate with the most votes in a contest on the tally report
- Create report which shows precinct count totals while the voting session is open
- Adjust the definition of a mark and implement changes to support
- Upgraded the OVO Printer Drivers to fix the “Printer is not connected” message after the printer paper has been changed
- *DHS Security Suggestion:* Improved file cleaning process for TMs to ensure that all files are securely deleted
- Will recognize FVT Provisional ballots as provisional “P” ballots and not as BMD “D” ballots and handle accordingly
- Will recognize the FVT’s Ballot Verification Number (BVN) in the second barcode on an FVT ballot to prevent ballots from being cast a second time

### **Tabulator**

- Implement Single Transferable Vote handling
- Allow automatic blanking of “0” in Voter Registration field
- Add "Elimination Only" option for RCV multiple seats method
- Append number of votes required to win (vote threshold) value to end of contest title in RCV tally report
- When "Multiple Deletions" is selected for tie breaking, if multiple deletion during tally process leads to continuing candidates less than seat number, we shall automatically switch to manual elimination (eliminate one at a time)
- Voter Registration totals entered by party

- Voter Reg Totals Entered by Parent or Child
- Increase maximum Manual Entry from 5,000 to 10,000

### **Tabulator Reports (TR)**

- Add option to print in bold the candidate with the most votes in a contest on the tally report
- Ensure that long contest titles are displayed on report
- Handle Voter registration totals entered by party
- When saving a report, the selected file format's extension (PDF or HTML) is automatically added to the end of the file name

### **Tabulator Client**

- Handle OVCS session data to be uploaded from TM
- *DHS Security Suggestion:* Improved file cleaning process for TMs to ensure that all files are securely deleted

### **All OCS Applications**

- Change 'X' icon on dialog box to perform Cancel function instead of 'OK' function
- Handle formatting tags in the Instruction blocks
- Update Window Favicon to display the correct application logo instead of the default Java logo
- Display more specific error message when an expired registration key is selected
- When the Print button is selected for reports, it will first save the report to a file and then print the report
- Require special characters for all OCS application passwords

### **OCS Installer**

- Prevent the 2.1 OCS application release from being installed on EOS 1.1 (CentOS 5.7) systems with networking. (Stand-alone mode only)

### **1.1.3 Initial Assessment**

Testing from the previous test campaign was used to establish the baseline. The focus of this test campaign is on the introduction of the end user enhancements, the enhancements implemented based on results of Vulnerability and Penetration testing conducted by DHS, and the addition of the CyberPower UPS Model CP1500AVRLCD for use with the OVO component.

Based on the submitted modifications, it was determined the following tasks would be required to verify compliance of the modifications:

- Source Code Review, Compliance Build, Trusted Build, and Build Document Review
- System Level Testing
  - System Integration
  - Accuracy
- Technical Documentation Package (TDP) Review
- Physical Configuration Audit, including System Loads and Hardening
- Functional Configuration Audit (FCA)
- Regression Testing
- Usability and Maintainability Testing
- Security Testing

#### **1.1.4 Regression Test**

Regression testing for this test campaign will consist of the execution of the System Integration Testing.

#### **1.2 References**

- Election Assistance Commission 2005 Voluntary Voting System Guidelines (VVSG) Version 1.0, Volume I, “Voting System Performance Guidelines”, and Volume II, “National Certification Testing Guidelines”
- Election Assistance Commission Testing and Certification Program Manual, Version 2.0
- Election Assistance Commission Voting System Test Laboratory Program Manual, Version 2.0
- National Voluntary Laboratory Accreditation Program NIST Handbook 150, 2016 Edition, “NVLAP Procedures and General Requirements (NIST HB 150-2016)”, dated July 2016
- National Voluntary Laboratory Accreditation Program NIST Handbook 150-22, 2008 Edition, “Voting System Testing (NIST Handbook 150-22)”, dated May 2008
- United States 107<sup>th</sup> Congress Help America Vote Act (HAVA) of 2002 (Public Law 107-252), dated October 2002
- Pro V&V, Inc. Quality Assurance Manual, Revision 7.0

- Election Assistance Commission “Approval of Voting System Testing Application Package” letter dated January 25, 2017
- EAC Requests for Interpretation (RFI) (listed on [www.eac.gov](http://www.eac.gov))
- EAC Notices of Clarification (NOC) (listed on [www.eac.gov](http://www.eac.gov))
- Pro V&V Test Report No. TR-01-01-UNI-003-01.01 Rev. A, “Test Report for EAC 2005 VVSG Certification Testing Unisyn Voting Solutions OpenElect 2.0 Voting System”
- OpenElect Voting System Release Notes, System 2.0.A to 2.1, Version 1.0
- Unisyn Voting Solutions Technical Data Package (*A listing of the OpenElect 2.1 documents submitted for this test campaign is listed in Section 4.5 of this Test Plan*)

### 1.3 Terms and Abbreviations

*This subsection lists terms and abbreviations relevant to the hardware, the software, or this Test Plan.*

“ADA” – Americans with Disabilities Act 1990

“BLM” – Ballot Layout Manager

“BMD” – Ballot Marking Device

“CM” – Configuration Management

“COTS” – Commercial Off-The-Shelf

“EAC” – United States Election Assistance Commission

“EM” – Election Manager

“EMS” – Election Management System

“EOS” - Election Operating System

“FCA” – Functional Configuration Audit

“FVT” – FreedomVote Tablet

“LAT” – Logic and Accuracy Test

“NOC” – Notice of Clarification

“OCS” – OpenElect Central Suite

“OVCS” – OpenElect Voting Central Scan

“OVI-VC” – OpenElect Voting Interface – Vote Center

“OVO” – OpenElect Voting Optical  
“OVS” – OpenElect Voting System  
“PC” – Personal Computer  
“PCA” – Physical Configuration Audit  
“QA” – Quality Assurance  
“RFI” – Request for Interpretation  
“RCV” – Rank Choice Voting  
“TC” – Tabulator Client  
“TDP” – Technical Data Package  
“TM” – Transport Media (USB Thumb Drive)  
“TR” – Tabulator Reports  
“UPS” – Uninterruptible Power Supply  
“VSTL” – Voting System Test Laboratory  
“VVSG” – Voluntary Voting System Guidelines

#### **1.4 Project Schedule**

The Project Schedule for the test campaign is located in Appendix A. The dates on the schedule are not firm dates but planned estimates based on the anticipated project work flow.

#### **1.5 Scope of Testing**

The scope of testing is limited to the modifications/enhancements implemented since the certification of the baseline system. These modifications include various software enhancements and defect fixes. The software enhancements focus on the introduction of end user enhancements as well as the enhancements implemented based on results of Vulnerability and Penetration testing conducted by DHS.

Based on this assessment, it was determined that multiple areas within the EAC 2005 VVSG would be evaluated to encompass the required tests. A breakdown of the areas and associated tests is listed below:

- EAC 2005 VVSG Volume 1, Section 2: Functional Requirements
  - System Integration Testing
  - Functional Configuration Audit (FCA)

- Physical Configuration Audit (PCA), including System Loads & Hardening
- Technical Documentation Package (TDP) Review
- Volume & Stress Testing
- Accuracy Testing
- EAC 2005 VVSG Volume 1, Section 3: Usability & Accessibility
  - Usability & Accessibility Testing
  - Technical Documentation Package (TDP) Review
- EAC 2005 VVSG Volume 1, Section 5: Software Requirements
  - Source Code Review, Compliance Build, Trusted Build, and Build Document Review
  - Technical Documentation Package (TDP) Review
  - Functional Configuration Audit (FCA)

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## 1.5.1 Block Diagram

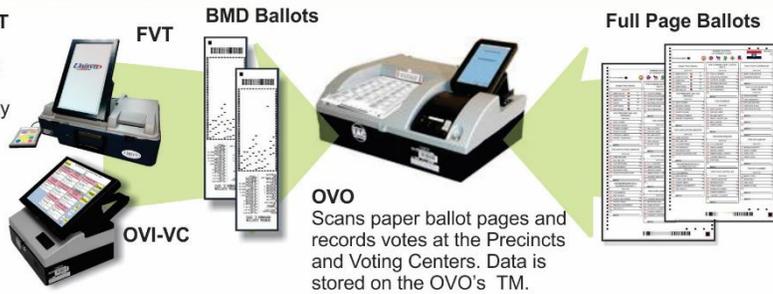
### Pre-Voting - Election Center/Central Count



### Voting - Poll Locations

The **OVI-VC** and **FVT** are ballot marking devices (BMDs) that produce printed ballots using a variety of Input Devices:

- Touchscreen
- Keypad
- Sip and Puff



### Post-Voting - Election Center/Central Count

**OVO**



**Transport Media (TM)** is removed from the OVO after voting has stopped and returned to Central Count.

**Tabulator Client**  
Insert Transport Media to store and upload vote files to Central Database.

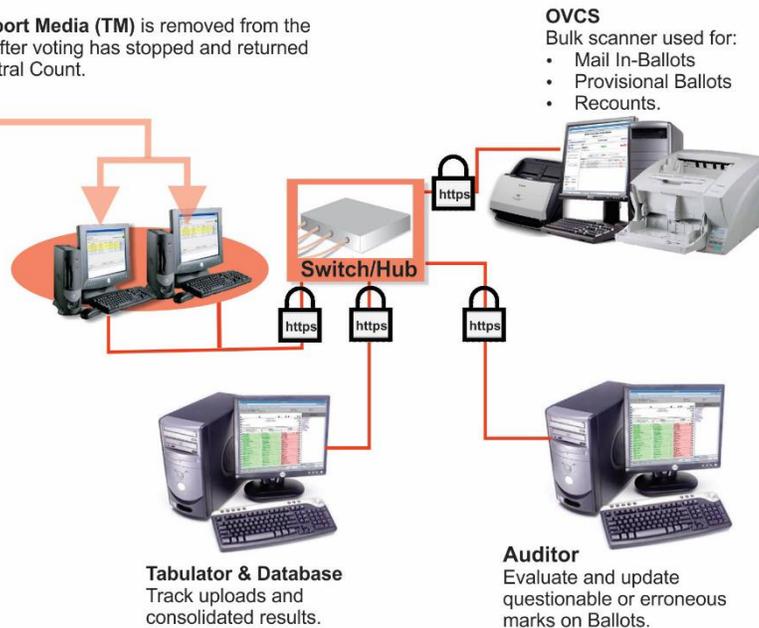


Figure 1-5. OVS 2.1 System Components Overview

## 1.5.2 System Limits

Unisyn has defined the following system performance characteristic limits for the OVS 2.1:

- The OCS and OVCS Software are intended for use by a single jurisdiction with one set of districts, voting centers, and precincts at any given time.
- The OCS and OVCS designed for handling up to 20 consecutive elections.
- Ten elections may be stored in the OCS database simultaneously.
- The system allows 2000 ballot styles for an election.
- One OVO can be initialized for use with ballots from 1-50 precincts, or all precincts.
- An OVI-VC and FVT can present all precincts to the voter.
- The system allows voting by precinct and split precinct.
- The OVO provides several voting sessions to accommodate different ballot counting purposes. Only one session can be used at a time:
  - **Election Day** voting at the polls and voting centers
  - **Training Election** voting for training or sales purposes
  - **Logic Test** voting to test data and tabulation
  - **Absentee** session
  - **Recount** session
  - **Provisional** session
  - **Regional Early Voting** session
- The OVO provides the following System Performance:
  - Expected speed (per ballot page)     5 seconds to ballot page confirm
  - Throughput capacity (per ballot page)     6 ballot pages per minute
  - Maximum Volume     5,000 ballot pages
  - Ballot Pages
    - 11” ballot page:
      - Maximum number of voting positions per ballot page (11 inch ballot pages, without Rank Choice Voting): 228
      - Maximum number of voting positions per ballot page (11 inch ballot pages, with Rank Choice Voting): 456
    - 14” ballot page:
      - Maximum number of voting positions per ballot page (14 inch ballot pages, without Rank Choice Voting): 300

- Maximum number of voting positions per ballot page (14 inch ballot pages, with Rank Choice Voting): 600
  - 17” ballot page:
    - Maximum number of voting positions per ballot page (17 inch ballot pages, without Rank Choice Voting): 372
    - Maximum number of voting positions per ballot page (17 inch ballot pages, with Rank Choice Voting): 744
  - 19” ballot page:
    - Maximum number of voting positions per ballot page (19 inch ballot pages, without Rank Choice Voting): 420
    - Maximum number of voting positions per ballot page (19 inch ballot pages, with Rank Choice Voting): 840
- Maximum number of ballot styles: 50 ballot styles per OVO session if individually entered with a maximum of 400 ballot style choices. For All Precinct sessions, all ballot styles are accepted by the OVO.
- The OVCS provides several voting sessions to accommodate different ballot counting purposes. Only one session can be used at a time:
  - Normal - Election Day Tabulation
    - Election Day Tabulation
    - Recount
    - Training
  - LAT - Logic and Accuracy Test (LAT) voting to test data and tabulation
  - Absentee session
  - Provisional session
  - Write-In only session
- The OVCS provides the following System Performance:
 

- Max Ballot pages per batch	500
- Max Ballot pages per session	5,000
- Expected speed (ballot pages per hour)	2,100 ballot pages per hour
- Maximum number of ballot styles:	400 ballot style choices

In the end-to-end OVS, a single election is limited to:

- Up to 12 political parties (including non-partisan) voting their own ballot in a Primary Election. Up to 12 political parties (including non-partisan) voting in a General Straight Ticket Election. Twenty-four parties may appear on the ballot for candidates.
- Up to 2,000 precincts.

- Up to 120 candidates per contest, with a limit of 3,000 combined count of candidates and contests.
- Up to 15 language translations (applies to ballot pages).
- Up to 3 ballot pages per ballot.
- Up to 5,000 ballot pages processed (cast votes) at an OVO during a single voting session.

### **1.5.3 Supported Languages**

The submitted voting system supports:

- Hindi
- Chinese
- English
- Japanese
- Korean
- Navajo
- Spanish
- Thai

Support for all stated languages will be verified; however, only English and Spanish language ballots will be cast during the performance of functional testing. Additionally, one character based language (Chinese) will be tested during System Integration Testing.

### **1.5.4 Supported Functionality**

The OVS 2.1 is designed to support the following voting variations:

- General Election
- Closed Primary
- Open Primary
- Early Voting
- Partisan/Non-Partisan Offices
- Write-In Voting
- Primary Presidential Delegation Nominations
- Straight Ticket Voting (*including Pennsylvania and Indiana Rules*)
- Presidential-only Voting
- Split Precincts

- Multiple Selection Contests: Vote for N of M
- Ballot Rotation
- Cross Party Endorsement
- Multi-Page Ballots
- Multi-Party Candidate Endorsements
- Provisional or Challenged Ballots
- Single Transferrable Vote
- Proportional Rotation
- Absentee Ballots
- Recount Tabulation
- Ranked Choice Voting (RCV)

#### **1.5.5 VVSG**

The OVS 2.1 shall be evaluated against the relevant requirements contained in the EAC 2005 VVSG, Volumes I and II.

#### **1.5.6 RFIs**

There are no RFIs released by the EAC as of the date of this Test Plan that pertain to this test campaign that were not in effect at the time of the baseline system certification.

#### **1.5.7 NOCs**

There are no NOCs released by the EAC as of the date of this Test Plan that pertain to this test campaign that were not in effect at the time of the baseline system certification.

### **2.0 PRE-CERTIFICATION TESTING AND ISSUES**

This section describes previous testing performed prior to submitting the voting system to the EAC.

#### **2.1 Evaluation of Prior VSTL Testing**

Pro V&V evaluated to the published Final Test Report for the OVS 2.1 System in order to baseline the current system under test.

#### **2.2 Evaluation of Prior Non-VSTL Testing**

No prior non-VSTL testing of the OVS 2.0.A modifications were considered for this test campaign.

#### **2.3 Known Field Issues**

There are no known field issues with the baseline system OVS 2.0.A. OVS 2.1 is a modification to the previously certified OVS 2.0.A system and has not been fielded.

### **3.0 MATERIALS REQUIRED FOR TESTING**

*The following sections list all materials needed to enable the test engagement to occur.*

The materials required for testing of the OVS 2.1 System include all materials to enable the test campaign to occur. This includes the applicable hardware and software as well as the TDP, test support materials, and deliverable materials, as described in the following subsections.

#### **3.1 Software**

*This subsection lists the proprietary and COTS software to be provided by the manufacturer as part of the test campaign.*

All software required for testing is identified in Section 1.1 of this test plan.

To verify that no source code was changed to implement the updated FIPS modules/libraries, which are called upon in the build process and included in the compile, Pro V&V will perform a comparison on the submitted source code.

#### **3.2 Equipment**

*This subsection lists the proprietary and COTS equipment to be provided by the manufacturer as part of the test campaign.*

For COTS equipment, every effort will be made to verify that the COTS equipment has not been modified for use. This will be accomplished by performing research using the COTS equipment manufacturer's websites based on the serial numbers and service tag numbers for each piece of equipment. Assigned test personnel will evaluate COTS hardware, system software and communications components for proven performance in commercial applications other than voting. For PCs, laptops, and servers, the service tag information will be compared to the system information found on each machine. Physical external and internal examination will also be performed when the equipment is easily accessible without the possibility of damage. Hard drives, RAM memory, and other components will be examined to verify that the components match the information found on the COTS equipment manufacturer's websites.

All hardware required for testing is identified in Section 1.1 of this test plan.

#### **3.3 Test Materials**

*This subsection lists the test materials required to execute the required tests throughout the test campaign.*

The materials required for certification testing of the OVS 2.1 include all previously identified software, hardware and test materials, as well as the deliverable materials listed below.

#### **3.4 Deliverable Materials**

*This subsection lists the materials identified by the manufacturer as materials deliverable to the end user for the system being tested.*

**Table 3-5. Voting System Deliverables**

<b>Material</b>	<b>Version</b>	<b>Description</b>
OCS	2.1	EMS Software Suite
OVO	2.1	Precinct Ballot Scanner
OVI-VC	2.1	Accessible Voting Station
OVCS	2.1	Central Count Scanner
FVT	2.1	Ballot Marking Device
Ballot Box	---	OVO Ballot Receptacle
Transport Media	1 GB	USB Flash Drive
CyberPower UPS	Entrust	UPS
Headphones (optional)	Koss, Sony	Stereo headphones
Sip and Puff (optional)	Origin AirVoter	Binary Input Device
OVS 2.1 TDP*	2.1	OVS Technical Data Package

\* Listed in Section 4.5

### **3.5 Proprietary Data**

All data and documentation considered by the manufacturer to be proprietary will be identified and documented in an independent submission along with a Notice of Protected Information.

### **4.0 TEST SPECIFICATIONS**

Certification testing of the OVS 2.1 System submitted for evaluation will be performed to ensure the applicable requirements of the EAC 2005 VVSG and the EAC Testing and Certification Program Manual, Version 2.0, are met. Additionally, all EAC Request for Interpretations (RFI) and Notices of Clarification (NOC) relevant to the system under test will be incorporated in the test campaign. A complete listing of the EAC RFIs and NOCs is available on the EAC website.

### **4.1 Requirements (Strategy of Evaluation)**

To evaluate the OVS 2.1 test requirements, the submitted modifications were evaluated against each section of the EAC 2005 VVSG to determine the applicable tests to be performed. Based on this assessment, it was determined the following evaluations would be required to verify compliance of the modifications:

#### Technical Documentation Package (TDP) Review

A TDP Review will be performed to ensure that all submitted modifications are accurately documented and that the documents meet the requirements of the EAC VVSG 1.0. The preliminary TDP review is performed to gather information concerning the system under test and its capabilities or design intentions. Additionally, a TDP review will be performed throughout the test campaign. The TDP Review includes the Initial Review, the Regulatory/Compliance Review, and the Final Review. This review is conducted to determine if the submitted technical documentation meets the regulatory, customer-stated, or end-user requirements and includes reviewing the documents for stated functionality and verification.

## Section 2: Functional Requirements

The requirements in this section shall be tested during the FCA, Accuracy Test, and System Integration Test. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The FCA targets the specific functionality claimed by the manufacturer to ensure the product functions as documented. This testing uses both positive and negative test data to test the robustness of the system. The FCA encompasses an examination of manufacturer tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP (such as system operations, voter manual, maintenance, and diagnostic testing manuals). It includes a test of system operations in the sequence in which they would normally be performed. These system operations and functional capabilities are categorized as follows by the phase of election activity in which they are required:

- Overall System Capabilities: These functional capabilities apply throughout the election process. They include security, accuracy, integrity, system audit ability, election management system, vote tabulation, ballot counters, telecommunications, and data retention.
- Pre-voting Capabilities: These functional capabilities are used to prepare the voting system for voting. They include ballot preparation, the preparation of election-specific software (including firmware), the production of ballots, the installation of ballots and ballot counting software (including firmware), and system and equipment tests.
- Voting System Capabilities: These functional capabilities include all operations conducted at the polling place by voters and officials including the generation of status messages.
- Post-voting Capabilities: These functional capabilities apply after all votes have been cast. They include closing the polling place; obtaining reports by voting machine, polling place, and precinct; obtaining consolidated reports; and obtaining reports of audit trails.
- Maintenance, Transportation and Storage Capabilities: These capabilities are necessary to maintain, transport, and store voting system equipment.

The system integration testing addresses the integration of the hardware and software. This testing focuses on the compatibility of the voting system software components and subsystems with one another and with other components of the voting system. During test performance, the system is configured as would be for normal field use.

The accuracy test ensures that each component of the voting system can each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test is designed to test the ability of the system to "capture, record, store, consolidate and report" specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data.

The FCA for this test campaign will include an assessment of the submitted modifications and will include inputs of both normal and abnormal data during test performance. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data. As part of the FCA, one primary and one general election will be executed to verify that each of the submitted modifications have been successfully implemented

### Section 3: Usability and Accessibility Requirements

The requirements in this section shall be tested during the Usability and Accessibility Testing. This evaluation will utilize baseline test cases as well as specifically designed test cases and will include predefined election definitions for the input data.

The usability testing focuses on the usability of the system being tested. Usability is defined generally as a measure of the effectiveness, efficiency, and satisfaction achieved by a specified set of users with a given product in the performance of specified tasks. In the context of voting, the primary user is the voter, the product is the voting system, and the task is the correct recording of the voter ballot selections. Additional requirements for task performance are independence and privacy: the voter should normally be able to complete the voting task without assistance from others, and the voter selections should be private. Accessibility evaluates the requirements for accessibility. These requirements are intended to address HAVA 301 (a) (3) (B).

### Section 5: Software Requirements

The requirements in this section shall be tested utilizing a combination of review and functional testing during the source code review, TDP review, and FCA.

To perform the source code review, Pro V&V will review the submitted source code to the EAC VVSG 1.0 and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is sufficient to enable: (1) a review of the source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met. The source code review includes a compliance build and a trusted build of the submitted source code

#### **4.1.1 Rationale for ‘Not Applicable’ Requirements**

The OVS 2.1 is a paper-based system that supports a closed network. Therefore, all EAC 2005 VVSG requirements, with the exceptions listed below, will be evaluated as part of this test campaign.

- Volume I, Section 7.7 (Wireless Communications)
- Volume I, Section 7.9 (Voter Verifiable Paper Audit Trail Requirements)

The rationale for not evaluating the OVS 2.1 to the indicated sections is described in following table.

**Table 4-1. Not Applicable Requirements**

<b>EAC 2005 VVSG Version 1 Volume I, Section</b>	<b>Rationale for ‘Not Applicable’</b>
7.7	No wireless technology is present in the Unisyn OVS 2.0.A.
7.9	The Unisyn OVS 2.0.A is a paper-based system

#### **4.2 Hardware Configuration and Design**

The Unisyn OVS 2.1 is a paper-based optical scan voting system. The OVS 2.1 consists of the following major components: the OCS, OVO precinct scanner, OVI-VC precinct voting interface, OVCS central count scanner, and FVT precinct voting tablet. All components of the OVO, excluding the case, are COTS. All components of the OVI-VC, excluding the case and keypad, are COTS. All components of the FVT, excluding the case, tablet enclosure, and keypad, are COTS. All components of the OVCS are COTS. All OCS functions are handled by proprietary software running on COTS PS/laptop/servers.

#### **4.3 Software System Functions**

The OCS/OVO/OVI-VC/OVCS software is a set of Java applications that utilize open source libraries and run on a customized Linux operating system to take advantage of that platform’s security and performance. The OVO and OVCS use the Java Native Interface (JNI) classes, which are C++ classes, to communicate with the native drivers (also C++) provided by the hardware manufacturer. This is required by the Optical Scanner in the OVO and the OVCS. The OpenElect system is designed for use in two distinct locales: Central Processing and In-Precinct Systems.

The FreedomVote Tablet (FVT) product is also written in Java, but compiled for use on the Google Android operating system, using different core libraries.

#### **4.4 Test Case Design**

Test cases are designed based on the manufacturer’s design specifications and the relevant technical requirements set forth by the VVSG. Test cases shall be based on the following aspects of the voting system:

- Hardware qualitative examination design
- Hardware environmental test case design
- Software module test case design and data
- Software functional test case design
- System level test case design

Test cases shall provide information regarding the sequence of actions to be performed for the execution of a test, the requirements being met, the test objective, test configuration, equipment

needed, special requirements, assumptions, and pass/fail criteria. Once the test cases are finalized, they will be validated and published for use in the test campaign. The validation of the test case will be accomplished by technical review and approval. This validation will include the following: confirmation of adequate test coverage of all requirements; confirmation that test case results are not ambiguous and gave objective pass/fail criteria; and confirmation that any automated test suites will produce valid results.

#### **4.4.1 Hardware Qualitative Design**

Previous hardware examinations were performed on the certified baseline system (OVS 2.0.A). The updates to the modified system require no additional hardware testing to be performed.

#### **4.4.2 Hardware Environmental Test Case Design**

Previous hardware examinations were performed on the certified baseline system (OVS 2.0.A). The updates to the modified system require no additional hardware testing to be performed.

#### **4.4.3 Software Module Test Case Design**

Pro V&V shall review the manufacturer's program analysis, documentation, and module test case design and shall evaluate the test cases for each module with respect to flow control parameters and entry/exit data. As needed, Pro V&V shall design additional test cases to satisfy the coverage criteria specified in Volume II, Section 7.2.1.

Component Level Testing will be implemented during the FCA for each component and subcomponent. During the source code review, compliance builds, and security testing, Pro V&V will utilize limited structural-based techniques (white-box testing).

Additionally, specification-based techniques (black-box testing) will be utilized for the individual software components.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

#### **4.4.4 Software Functional Test Case Design**

Pro V&V shall review the manufacturer-submitted test plans and data to verify that the individual performance requirements specified in the EAC 2005 VVSG and the TDP are reflected in the software. As part of this process, Pro V&V shall review the manufacturer's test case design and prepare a detailed matrix of system functions and the test cases that exercise them. Pro V&V shall also prepare a test procedure describing all test ballots, operator procedures, and the data content of output reports. Pro V&V shall define abnormal input data and operator actions and then design test cases to verify that the system is able to handle and recover from these abnormal conditions. During this review, emphasis shall be placed on those functions where the manufacturer data on

module development, such as the system release notes and comments within the source code, reflects significant debugging problems, and on functional tests that resulted in high error rates.

Pro V&V shall define the expected result for each test and the ACCEPT/REJECT criteria for certification. If the system performs as expected, the results will be accepted. If the system does not perform as expected, an analysis will be performed to determine the cause. The test will be repeated in an attempt to reproduce the results. If the failure can be reproduced and the expected results are not met, the system will have failed the test. If the results cannot be reproduced, the test will continue. All errors encountered will be documented and tracked through resolution.

#### 4.4.5 System-Level Test Case Design

System Level testing will be implemented to evaluate the complete system. This testing will include all proprietary components and COTS components (software, hardware, and peripherals) in a configuration of the system’s intended use. For software system tests, the tests shall be designed according to the stated design objective without consideration of its functional specification. The system level hardware and software test cases shall be prepared independently to assess the response of the hardware and software to a range of conditions.

#### 4.5 TDP Evaluation

In order to determine compliance of the modified TDP documents with the EAC 2005 VVSG, a limited TDP review shall be conducted. This review will focus on TDP documents that have been modified since the certification of the baseline system. The review will consist of a compliance review to determine if each regulatory, state, or manufacturer-stated requirement has been met based on the context of each requirement. Results of the review of each document will be entered on the TDP Review Checklist and reported to the manufacturer for disposition of any anomalies. This process will be ongoing until all anomalies are resolved. Any revised documents during the TDP review process will be compared with the previous document revision to determine changes made, and the document will be re-reviewed to determine whether subject requirements have been met.

A listing of all documents contained in OVS 2.1 TDP is provided in Table 4-2.

**Table 4-2. TDP Documents**

<b>Document Number</b>	<b>Description</b>	<b>Version</b>	<b>Release</b>
04-00512	Technical Data Package-Document List and Version Control	1.0	2.1
04-00446	OVS System Overview	1.3	2.1
04-00444	System Functionality Description	1.0	2.1
04-00458	System Hardware Specification	1.1	2.1
04-00464	Software Design and Specification	1.1	2.1
04-00447	System Security Specification	1.0	2.1
04-00453	System Test and Verification Plan	1.0	2.1

**Table 4-2. TDP Documents** *(continued)*

<b>Document Number</b>	<b>Description</b>	<b>Version</b>	<b>Release</b>
04-00460	Systems Operations Procedure: Warehouse Technician's Guide	1.0	2.1
04-00459	System Maintenance Procedures	1.0	2.1
04-00445	Personnel Training and Deployment Requirements	1.0	2.1
04-00448	Configuration Management Plan	1.0	2.1
04-00454	Quality Assurance Plan	1.0	2.1
04-00469	Final QA Report	1.0	2.1
04-00427	Election Manager User Guide	1.2	2.1
04-00428	Ballot Layout Manager User Guide	1.3	2.1
04-00431	Tabulator Client User Guide	1.1	2.1
04-00432	Tabulator User Guide	1.0	2.1
04-00433	Tabulator Reports User Guide	1.0	2.1
04-00495	OVCS User Guide	1.3	2.1
04-00530	Auditor Users Guide	1.0	2.1
04-00549	EOS Linux and OCS Installation Guide	1.6	2.1
04-00449	System Coding Standards	1.0	2.1
04-00462	Election Day Troubleshooter's Guide	1.0	2.1
04-00463	Election Day Poll Worker's Guide	1.1	2.1
04-00494	OVS Acronyms	1.0	2.1
04-00503	OVS Paper Specification	1.0	2.1
04-00553	Trusted Build – Applications 2.1	2.8	2.1
04-00513	System Hardware Verification	1.0	2.1
04-00594	OpenElect Voting System Release Notes, 2.0.A to 2.1	1.2	2.1

#### **4.6 Source Code Review**

Pro V&V will review the submitted source code to the EAC 2005 VVSG and the manufacturer-submitted coding standards. Prior to initiating the software review, Pro V&V shall verify that the submitted documentation is sufficient to enable: (1) a review of the modified source code and (2) Pro V&V to design and conduct tests at every level of the software structure to verify that design specifications and performance guidelines are met.

A combination of Automated Source Code Review and Manual Source Code Review methods will be used to review the changes in the source code from the previously certified system. In addition, 10% of the source code comments will be manually reviewed.

#### **4.7 QA and CM System Review**

The Unisyn Quality and Configuration Management Manuals shall be reviewed for their fulfillment of Volume I, Sections 8 and 9, and the requirements specified in Volume II, Section 2. The requirements for these sections establish the quality assurance and configuration standards for voting systems to which manufacturers must conform and require voting system manufacturers to implement a quality assurance and configuration management program that is

conformant with recognized ISO standards. As part of the review process, the Unisyn TDP documents will be reviewed to determine if the stated policies are being followed.

#### **4.8 PCA**

The physical configuration audit compares the voting system components submitted for qualification to the manufacturer's technical documentation, and shall include the following activities:

- Establish a configuration baseline of software and hardware to be tested; confirm whether manufacturer's documentation is sufficient for the user to install, validate, operate, and maintain the voting system
- Verify software conforms to the manufacturer's specifications; inspect all records of manufacturer's release control system; if changes have been made to the baseline version, verify manufacturer's engineering and test data are for the software version submitted for certification
- If the hardware is non-COTS, Pro V&V shall review drawings, specifications, technical data, and test data associated with system hardware to establish system hardware baseline associated with software baseline
- Review manufacturer's documents of user acceptance test procedures and data against system's functional specifications; resolve any discrepancy or inadequacy in manufacturer's plan or data prior to beginning system integration functional and performance tests
- Subsequent changes to baseline software configuration made during testing, as well as system hardware changes that may produce a change in software operation are subject to re-examination

#### **4.9 FCA**

The functional configuration audit encompasses an examination of manufacturer's tests, and the conduct of additional tests, to verify that the system hardware and software perform all the functions described in the manufacturer's documentation submitted in the TDP.

In addition to functioning according to the manufacturer's documentation tests will be conducted to insure all applicable EAC 2005 VVSG requirements are met.

#### **4.10 Accuracy**

The accuracy test ensures that each component of the voting system can each process 1,549,703 consecutive ballot positions correctly within the allowable target error rate. The Accuracy test is designed to test the ability of the system to "capture, record, store, consolidate and report" specific selections and absences of a selection. The required accuracy is defined as an error rate. This rate is the maximum number of errors allowed while processing a specified volume of data. For paper-based voting systems the ballot positions on a paper ballot must be scanned to detect selections for individual candidates and contests and the conversion of those selections detected on the paper ballot converted into digital data.

In an effort to achieve this and to verify the proper functionality of the units under test, the following methods will be used to test components of the voting system:

The OVO and OVCS shall be tested by utilizing a combination of hand marked (70%) and pre-marked (30%) ballots to achieve accuracy rate greater than 1,549,703 correct ballot positions. The OVI-VC and FVT shall be utilized to create ballots that will be implemented as part of the pre-marked test deck.

#### **4.11 System Integration**

System Level test for the integrated operation of both hardware and software. Compatibility of the voting system software components or subsystems with one another, and with other components of the voting system environment, shall be determined through functional tests integrating the voting system software with the remainder of the system.

Additionally, the system shall be configured exactly as it would for normal field use. This includes connecting all supporting equipment and peripherals including ballot boxes, voting booths (regular and accessible), and any physical security equipment such as locks and ties.

Pro V&V personnel shall properly configure and test the system by following the procedures detailed in the OVS 2.1 voting system technical documentation.

#### **4.12 Security Testing**

Security testing will be performed to evaluate the effectiveness of the voting system in detecting, preventing, recording, reporting, and recovering from security threats and to determine the overall security posture of each system component. For this test campaign logical security testing will be performed to verify that the EOS 4.0.03 OS introduced in this test campaign is properly configured per the recommendations provided in the Security Content Automation Protocol (SCAP) specifications.

### **5.0 TEST DATA**

The following subsections provide information concerning test data recording, criteria, and reduction.

#### **5.1 Test Data Recording**

All equipment utilized for test data recording shall be identified in the test data package. The output test data shall be recorded in an appropriate manner as to allow for data analysis. For source code and TDP reviews, results shall be compiled in reports and submitted to Unisyn for resolution.

#### **5.2 Test Data Criteria**

The OVS 2.1 shall be evaluated against all applicable requirements contained in the EAC 2005 VVSG. The acceptable range for system performance and the expected results for each test case

shall be derived from the manufacturer-submitted technical documentation and the EAC 2005 VVSG.

### **5.3 Test Data Reduction**

Test data shall be processed and recorded in the test log book and the relevant Test Cases.

## **6.0 TEST PROCEDURE AND CONDITIONS**

The following subsections detail the facility requirements, test setup conditions, and sequence of testing.

### **6.1 Facility Requirements**

Unless otherwise annotated, all testing shall be conducted at the Pro V&V test facility located in Huntsville, AL, by personnel verified by Pro V&V to be qualified to perform the test. Unless otherwise specified herein, testing shall be performed at the following standard ambient conditions and tolerances:

- Temperature: 68-75° F ( $\pm 3.6^\circ\text{F}$ )
- Relative Humidity: Local Site Humidity
- Atmospheric Pressure: Local Site Pressure
- Time Allowable Tolerance:  $\pm 5\%$

Testing performed at third-party laboratories will be subject to the test parameters and tolerances defined by VVSG. If not specified in VVSG, the test facilities' standard parameters and tolerances will be used. These shall be reported in the final Test Report.

### **6.2 Test Set-up**

All voting system equipment shall be received and documented using Pro V&V proper QA procedures. Upon receipt of all hardware, an inspection will be performed to verify that the equipment received is free from obvious signs of damage and/or degradation that may have occurred during transit. If present, this damage shall be recorded, photographed, and reported to the Unisyn Representative. Additionally, a comparison shall be made between the recorded serial numbers/part numbers and those listed on shipper's manifest and any discrepancies shall be reported to the Unisyn Representative. TDP items and all source code received shall be inventoried and maintained by Pro V&V during the test campaign.

During test performance, the system shall be configured as it would be for normal field use. This includes connecting all supporting equipment and peripherals.

### **6.3 Test Sequence**

The OVS 2.1 will be evaluated against all applicable requirements in the EAC 2005 VVSG. There is no required sequence for test performance.

#### **6.4 Test Operations Procedure**

Pro V&V will identify PASS/FAIL criteria for each executed test case. The PASS/FAIL criteria will be based on the specific expected results of the system. In the case of an unexpected result that deviates from what is considered standard, normal, or expected, a root cause analysis will be performed.

Pro V&V will evaluate every EAC 2005 VVSG requirement applicable to the OVS 2.1 voting system. Any deficiencies noted will be reported to the EAC and the manufacturer. If it is determined that there is insufficient data to determine compliance, this test plan will be altered and additional testing will be performed.

**APPENDIX A**  
**PROJECT SCHEDULE**

<b>Task Name</b>	<b>Start Date</b>	<b>End Date</b>	<b>Duration</b>
<b>EAC Application &amp; TRR</b>	<b>03/27/19</b>	<b>05/15/19</b>	<b>36d</b>
Application Submitted to EAC	03/27/19	03/27/19	1d
TRR	04/22/19	04/24/19	3d
Application Approval from EAC	04/25/19	05/15/19	15d
<b>TDP</b>	<b>05/08/19</b>	<b>09/03/19</b>	<b>85d</b>
Initial Review	05/08/19	06/03/19	19d
Compliance Review	06/04/19	08/16/19	54d
Final review	08/19/19	09/03/19	12d
<b>Test Plan</b>	<b>06/03/19</b>	<b>08/08/19</b>	<b>49d</b>
Test Plan Creation	06/03/19	06/14/19	10d
Vendor Review & Comments	06/17/19	06/18/19	2d
EAC Submission and Review	06/19/19	07/16/19	20d
VSTL Comment Review & Update	07/17/19	07/23/19	5d
EAC Submission & Review of Revision	07/24/19	08/06/19	10d
EAC Approved Test Plan	08/07/19	08/08/19	2d
<b>Source Code</b>	<b>06/03/19</b>	<b>06/17/19</b>	<b>11d</b>
Automated Review	06/03/19	06/04/19	2d
Source Code Review	06/03/19	06/07/19	5d
Source Code Re-Review	06/10/19	06/11/19	2d
Document Review	06/12/19	06/12/19	1d
Compliance Build	06/13/19	06/17/19	3d
<b>System Delivery &amp; Setup</b>	<b>04/22/19</b>	<b>07/30/19</b>	<b>72d</b>
PCA	04/22/19	06/03/19	31d

System Setup	04/22/19	06/03/19	31d
System Loads & Hardening	04/22/19	06/03/19	31d
<b>Hardware Testing</b>	<b>07/08/19</b>	<b>07/30/19</b>	<b>17d</b>
Electrical Testing (FVT & OVO)	07/08/19	07/19/19	10d
Temp Power (FVT & OVO)	07/22/19	07/26/19	5d
Electrical Supply	07/29/19	07/29/19	1d
Maintainability	07/30/19	07/30/19	1d
<b>System Level Testing</b>	<b>07/31/19</b>	<b>09/03/19</b>	<b>25d</b>
FCA	07/31/19	08/13/19	10d
Usability	08/14/19	08/15/19	2d
Accuracy	08/16/19	08/20/19	3d
Regression Testing	08/21/19	08/21/19	1d
Trusted Build	08/22/19	08/23/19	2d
System Loads & Hardening	08/26/19	08/27/19	2d
System Integration	08/28/19	09/03/19	5d
<b>Test Report</b>	<b>08/28/19</b>	<b>10/30/19</b>	<b>46d</b>
Test Report Creation	08/28/19	09/10/19	10d
Vendor Review & Comments	09/11/19	09/12/19	2d
EAC Submission & Review	09/13/19	10/10/19	20d
VSTL Comment Review & Update	10/11/19	10/15/19	3d
EAC Submission & Review of Revision	10/16/19	10/29/19	10d
EAC Approved Test Report	10/30/19	10/30/19	1d